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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1.	Your reference	BP-09-0393
2.	Patent application number *(The Patent Office will fill in this part)*	0326271.4
3.	Full name, address and postcode of the or of each applicant *(underline all surnames)* Patents ADP number *(if you know it)* If the applicant is a corporate body, give the country/state of its incorporation	Morganite Electrical Carbon Limited Upper Fforest Way Morriston Swansea SA6 8PP United Kingdom 6135050005
4.	Title of the invention	Composite Collectors
5.	Name of your agent *(if you have one)* "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)* Patents ADP number *(if you know it)*	Phillips & Leigh 5 Pemberton Row London EC4A 3BA United Kingdom 1289001

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application		Date of filing *(day / month / year)*
8.	Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:* *a) any applicant named in part 3 is not an inventor, or* *b) there is an inventor who is not named as an applicant, or* *c) any named applicant is a corporate body.* *See note (d))*	Yes		

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Continuation sheets of this form	
Description	5
Claim(s)	1
Abstract	1
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10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translation of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	1
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature: Phillips & Leigh

Date: 11th November 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

Phillips & Leigh
020 7822 8888
J.C. Boff

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Notes

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Composite Collectors

This invention relates to composite collectors for electrical apparatus. The invention also relates to methods of making such collectors.

Collectors are used to transfer electricity to or from a conductor and to make sliding contact with the conductor.

In the past these materials have traditionally fallen into three categories: -

- Extruded – A soft mouldable carbon is produced by the mixing of coke and graphite with a tar or pitch binder. This material can be extruded through dies and a wide variety of cross sections obtained. After extrusion kilning is performed resulting in strong porous carbon.

- Metallised – The porous nature of the extruded carbon can be utilised to perform metallisation. Molten metal is forced under pressure into the pores of the material. This increases mechanical strength and electrical and thermal conductivity. The metal impregnation process is labour intensive and thus costly.

- Sintered – These are produced by mixing metals and graphite powders that are then pressed to shape and heat treated. Electrical and thermal conductivity is excellent but mechanical strength is generally lower than in extruded or metallised grades. Greater weight is also a potential disadvantage.

The applicants have realised that a drawback of existing collectors is that their resistivity is determined by the resistivity of the carbon, or for metallised or sintered materials, by the metal content and connectivity of the metal. It would be preferable to have a continuous metal conductor mounted in a tribologically acceptable matrix (e.g. carbon).

By providing a metal mesh embedded in a tribologically acceptable matrix the resultant material will have a low resistivity (due to the continuous electrical path supplied by the metal mesh) and high flexural strength (due to the composite nature of the material).

Additionally the complexity of a metal impregnation step is avoided.

Accordingly the present invention provides a composite electrical collector comprising a metal mesh embedded in a tribologically acceptable matrix.

The tribologically acceptable matrix may be a carbon based material.

Such a collector can provide a continuous current path through the mesh from the conductor to the remote side of the collector, hence the system resistance will be low.

Further features of the invention are as set out in the claims as exemplified in the following description in which:-

Fig. 1 shows a method of forming a collector according to the invention
Fig. 2 is a photograph of a product made to the method of Fig. 1

Composite collectors according to the invention can be made by providing layers of a metal mesh and a tribologically suitable material, and pressing the layers to permit the tribologically suitable material to merge through apertures in the mesh and thereby form the composite body.

For example, as shown in Fig 1, a collector can be formed, under pressure and heat, from a composite material of alternative layers consisting of:-

a) coke, graphite and a phenolic novolak resin; and
b) an expanded copper mesh.

The coke/graphite/resin layers 1, and copper mesh layers 2 are interleaved and pressed in pressing direction 3.

The result is a layered composite material and Fig. 2 shows this.

Example

1. The coke/graphite/resin mix is prepared in the following manner
2. A pre-mix is prepared by blending the following components in a low-energy mixer, such as a 'Z' blade mixer, at ambient temperature.

Petroleum Coke – Grade Z11C(K) from James Durrans & Sons Ltd, Sheffield, England	~ 50%
Foundry Coke – Grade NH358(N) manufactured at Morganite Electrical Carbon Limited, Swansea, Wales	~ 31%
Lamp Black – Grade Z35 from Laporte Pigments Brockhues AG, Walluf, Germany	~ 15%
Graphite – Grade Hart 80 from David Hart Ltd., Alcester, England	~ 5%

3. This material is then mixed in a high-energy Intermixer™ at 70-80°C with the following components: -

Pre-mix 1	~ 77%
Phenolic resin – Grade PR82 from Borden Chemicals Ltd., Sully, Wales	~ 19%
Hexamine – from VWR International, Poole, England	2.0%
Nylon fibres –from Alpha Electrostatic Flocking Ltd., Kenfig, Wales	2.0%

4. This material is crushed to a fine powder and mixed with propan-2-ol (100g solids to 25ml solvent) to form a paste (Component 1).

(N.B. Whilst the composition of component 1 is predominantly carbon based, because the metallic mesh provides the electrical conduction path, the interlayer material may be an insulator e.g. ceramic materials or a carbon/ceramic mix with the appropriate tribological properties.)

5. The paste is then placed onto a surface and rolled flat. An expanded copper mesh such as Expamet Grade 947 [from The Expanded Metal Company, Hartlepool, england] (Component 2) is then placed onto the sheet and a further layer of paste applied and spread over the copper. This is then rolled into a sheet approximately 1-2mm thick.

6. The sheets are left to dry at 50°C.

7. The sheets are then cut to appropriate size.

8. The cut sheets are then stacked upon each other (the number depending on the thickness of the block required) and the required shape is pre-formed by pressing in a die at ambient temperature at 1-2 tonnes/in^2 (~15-50MPa).

9. This pre-form is then hot pressed at 160°C at 2-5 tonnes/in^2 (30-75MPa) for 5 minutes to form a solid block.

10. The block is then further cured by heating at 10°C/hour to 180°C. It is held at this temperature for a further 2 hours.

11. The block is kilned by heating at 50°C/hour to 800°C in an inert atmosphere, for example of 98% nitrogen and 2% hydrogen. It is held at this temperature for a further 2 hours.

Typical properties of this material are: -

Density 1.90gcm^{-3}.

Resistivity <1$\mu\Omega$.m (in the direction of the copper mesh).

Fabrication need not involve hot pressing, any route that enables a laminated structure to be prepared e.g. rolling can be utilised. For example, the process of extruding sheet materials described in WO02/090291 lends itself to the rolling-in of mesh materials into a graphite or carbon sheet.

After forming the laminated structure, the structure may be impregnated with resin or other materials to improve characteristics (e.g. strength, tribological properties etc.)

Prepared materials have been mounted and tested on a dynamic pantograph test rig and have been shown to give comparable wear results to field trials i.e. ~10mm/10000km.

The material may be mounted in any conventional manner and may if desired be sheathed to protect against delamination or other damage.

CLAIMS

1. A composite electrical collector comprising a metal mesh embedded in a tribologically acceptable matrix.

2. A composite electrical collector as claimed in Claim 1, in which the tribologically acceptable matrix is a carbon based material.

3. A composite electrical collector as claimed in Claim 2, in which the carbon based material is a coke/graphite/resin mix

4. A composite electrical collector as claimed in any one of Claims 1 to 3 , in which the metal mesh is a copper mesh.

5. A composite electrical collector as claimed in any one of Claims 1 to 4, in which the metal mesh embedded in a tribologically acceptable matrix consists of a pressed laminated body of matrix material and metal mesh.

6. A method of making a composite electrical collector as claimed in any preceding claim in which layers of matrix material and metal mesh are pressed together to form a laminated structure.

7. A method, as claimed in Claim 6, in which the laminated structure is raised to an elevated temperature after or during pressing.

8. A method, as claimed in Claim 7, in which the laminated structure is kilned under an inert atmosphere.

9. A method, as claimed in any one of Claims 6 to 8, in which the laminated structure is impregnated after forming.

ABSTRACT

A composite electrical collector comprises a metal mesh embedded in a tribologically acceptable matrix

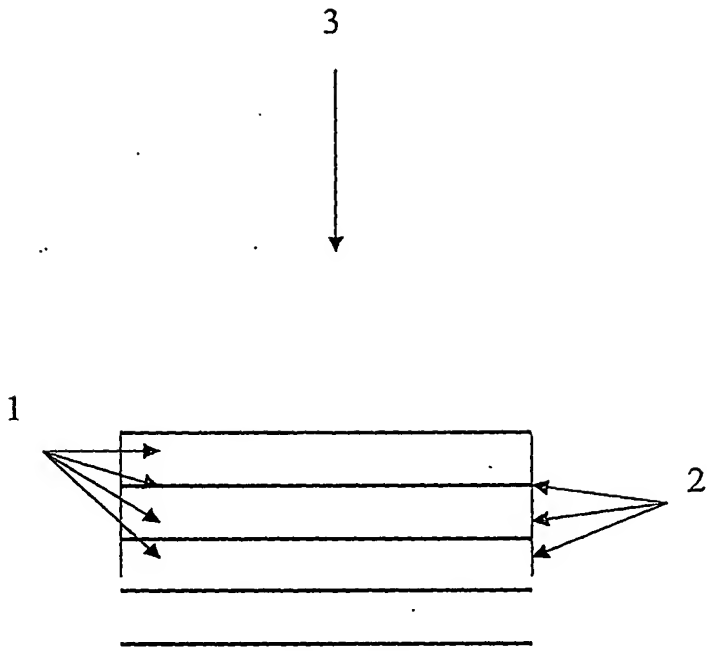

Fig. 1

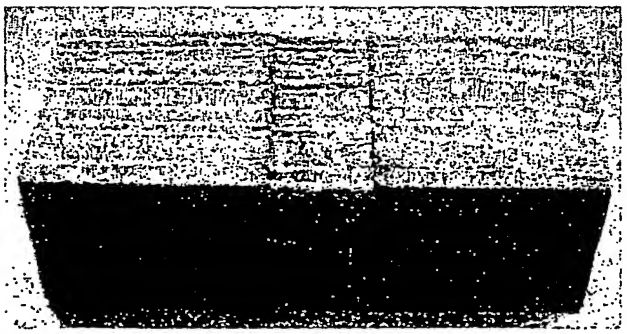

Fig. 2